

What is claimed with:

1. A hybrid compressor device for a vehicle having an engine that is stopped when the vehicle is temporally stopped, the hybrid compressor device comprising:

a pulley rotated by the engine;

a motor rotated by electric power from a battery of the vehicle;

a compressor for compressing refrigerant in a refrigerant cycle system, the compressor being operated by driving force of the pulley and driving force of the motor; and

a transmission mechanism connected respectively independently to a rotational shaft of the pulley, a rotational shaft of the motor and a rotational shaft of the compressor, the transmission mechanism being provided for changing a rotational speed of the pulley and a rotational speed of the motor, to be transmitted to the compressor, wherein:

the pulley, the motor and the compressor are disposed to be rotatable independently; and

the rotational speed of the compressor is changed by adjusting the rotational speed of the motor with respect to the rotational speed of the pulley.

2. The hybrid compressor device according to claim 1, further comprising

a control unit for adjusting the rotational speed of the motor,

wherein the control unit changes the rotational speed of the

compressor, by adjusting the rotational speed of the motor with respect to the rotational speed of the pulley.

3. The hybrid compressor device according to claim 2, wherein the transmission mechanism is a planetary gear including a sun gear, a planetary carrier and a ring gear; and the rotational shafts of the pulley, the motor and the compressor are connected to the sun gear, the planetary carrier and the ring gear.

4. The hybrid compressor device according to claim 3, wherein the rotational shaft of the compressor is connected to the planetary carrier.

5. The hybrid compressor device according to claim 4, wherein: the rotational shaft of the pulley is connected to the sun gear; and the rotational shaft of the motor is connected to the ring gear.

6. The hybrid compressor device according to claim 3, wherein: the rotational shaft of the pulley is connected to the planetary carrier; the rotational shaft of the motor is connected to the sun gear; and the rotational shaft of the compressor is connected to the ring gear.

7. The hybrid compressor device according to claim 6, further comprising:

an interrupter for interrupting driving force from the engine to the rotation shaft of the pulley by the control unit; and

a one-way clutch disposed near the transmission mechanism between the transmission mechanism and the interrupter in an axial direction of the rotation shaft of the pulley, for allowing the rotational shaft of the pulley to only rotate in one rotational direction of the pulley; and

when the engine is operated, the control unit operates the compressor by turning off the interrupter and by driving the motor in a rotational direction opposite to the one rotational direction of the pulley.

8. The hybrid compressor device according to claim 3, wherein the rotational shaft of the pulley is connected to the planetary carrier, the hybrid compressor device further comprising

a one-way clutch for allowing the rotational shaft of the motor to only rotate in a rotational direction opposite to a rotational direction of the pulley.

9. The hybrid compressor device according to claim 8, wherein:  
the rotational shaft of the motor is connected to the sun gear; and

the rotational shaft of the compressor is connected to the ring gear.

10. The hybrid compressor device according to claim 1, wherein the compressor is a fixed displacement compressor where a discharge amount per rotation is set at a predetermined amount.

11. The hybrid compressor device according to claim 1, wherein:

the motor is a surface permanent-magnet motor which includes a rotor portion and permanent magnets on an outer periphery of the rotor portion; and

the transmission mechanism is disposed in the rotor portion.

12. The hybrid compressor device according to claim 2, further comprising

a lock mechanism for locking the rotational shaft of the motor when the motor is stopped;

when the compressor is operated by driving force of the pulley while the motor is stopped, the control unit detects fluctuation of an induced voltage of the motor by detecting leakage fluctuation of magnetic flux of the motor generated due to rotation of the transmission mechanism connected to the compressor.

13. The hybrid compressor device according to claim 12, wherein:

the motor is a surface permanent-magnet motor which includes a rotor portion and permanent magnets on an outer periphery of the rotor portion;

the transmission mechanism, connected to the compressor, includes at least a pair of a recess portion and a protrusion portion at a center side with respect to the permanent magnets in a radial direction of the rotor portion; and

the pair of the recess portion and the protrusion portion is provided to generate the leakage fluctuation of the magnetic flux of the motor.

14. The hybrid compressor device according to claim 12, wherein:

the transmission mechanism is a planetary gear including a sun gear, a planetary carrier and a ring gear; and

the ring gear is connected to the compressor.

15. The hybrid compressor device according to claim 14, wherein:

the rotational shaft of the pulley is connected to the planetary carrier; and

the rotational shaft of the motor is connected to the sun gear.

16. The hybrid compressor device according to claim 12, further comprising

an interrupter for interrupting driving force from the engine to the rotation shaft of the pulley by the control unit; and

when the fluctuation of the induced voltage of the motor is smaller than a predetermined value, the interrupter is turned off

by the control unit.

17. A hybrid compressor device for a vehicle having an engine that is stopped in a predetermined running condition of the vehicle, the vehicle including a driving motor for driving the vehicle, the hybrid compressor device comprising:

a pulley rotated by the engine;

a motor rotated by electric power from a battery of the vehicle;

a compressor for compressing refrigerant in a refrigerant cycle system, the compressor being operated by driving force of the pulley and driving force of the motor;

a transmission mechanism connected respectively independently to a rotational shaft of the pulley, a rotational shaft of the motor and a rotational shaft of the compressor, the transmission mechanism being provided for changing at least one of rotational speeds of the pulley, the motor and the compressor, to be transmitted to at least the other one of the pulley, the motor and the compressor; and

a control unit for adjusting the rotational speed of the motor, wherein:

the pulley, the motor and the compressor are disposed to be rotatable independently; and

the control unit changes the rotational speed of the compressor, by adjusting the rotational speed of the motor with respect to the rotational speed of the pulley.

18. The hybrid compressor device according to claim 1, wherein the compressor having a suction area into which refrigerant before being compressed is introduced, a discharge area into which compressed refrigerant flows, and an oil separating unit for separating lubricating oil contained in refrigerant from the refrigerant and for storing the separated lubrication oil in the discharge area, the hybrid compressor further comprising

a housing for accommodating therein the motor and the transmission mechanism;

an oil introduction passage through which the lubrication oil in the discharge area of the compressor is introduced into the housing; and

a communication passage through which an inner side of the housing communicates with the suction area of the compressor.

19. A hybrid compressor device comprising:

a driving unit rotated by receiving driving force from an outside driving source;

a motor rotated by receiving electric power from an outside power source;

a compressor operated by at least one of the driving unit and the motor, the compressor being for compressing refrigerant in a refrigerant cycle system, the compressor including

a suction area into which refrigerant before being compressed is introduced,

a discharge area into which compressed refrigerant flows, and

an oil separating unit for separating lubrication oil contained in refrigerant from the refrigerant and for storing the separated lubrication oil in the discharge area; a transmission mechanism disposed between the compressor and at least any one of the driving unit and the motor, the transmission mechanism being for changing a rotational speed of the at least one of the driving unit and the motor, to be transmitted to the compressor;

a housing for accommodating therein the motor and the transmission mechanism; and

means for forming an oil introducing passage through which the lubrication oil stored in the discharge area is introduced into the housing,

wherein an inner space of the housing communicates with the suction area through a communication passage.

20. The hybrid compressor device according to claim 19, wherein:

at least one of the compressor and the housing has a suction port from which the refrigerant is introduced into the suction area of the compressor.

21. The hybrid compressor device according to claim 19, wherein:

the housing is disposed to accommodate the compressor, the motor and the transmission mechanism; and

the housing has a suction port, from which the refrigerant

is sucked into the compressor, at a side where the motor and the transmission mechanism are disposed.

22. The hybrid compressor device according to claim 19, wherein:

the oil introduction passage is a decompression passage through which the discharge area communicates with the inner space of the housing while a pressure from the discharge area is reduced in the communication passage.

23. The hybrid compressor device according to claim 19, wherein:

the transmission mechanism includes a plurality of movable members;

the housing has a storage wall for storing a predetermined amount of the lubrication oil in the housing;

the storage wall has a top end at a position higher than a contact portion between the movable portions; and

the communication passage is provided at a position lower than the top end of the storage wall.

24. The hybrid compressor device according to claim 19, wherein

the oil introduction passage is a first decompression passage through which the discharge area communicates with the inside of the housing while pressure is reduced from the discharge area toward the inside of the housing; and

the communication passage is a second decompression passage through which the inside of the housing communicates with the suction area while pressure is reduced from the inside of the housing toward the suction area.

25. The hybrid compressor device according to claim 19, wherein the lubrication-oil separating unit is a centrifugal separator disposed in the discharge area.

26. The hybrid compressor device according to claim 20, further comprising

a check valve provided in the suction port, for preventing the lubrication oil from flowing out from the housing through the suction port.

27. The hybrid compressor device according to claim 19, wherein:

the compressor includes a compression portion for compressing refrigerant, and a discharge port from which compressed refrigerant is discharged outside the compressor; and

the housing and the discharge port are provided at both sides of the compression portion in a rotational axial direction of the compressor.